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(54) A pay phone system or a pay service system.

(57) In a pay phone system, a plurality of pay phone apparatuses (40) and a remote central computer (54) are included. The pay phone apparatuses (40) communicate with the central computer (54) through telephone lines and further via a telephone central exchange (52). The pay phone apparatuses (40) are operated by means of magnetic cards (55, 56 or 57) or optionally by means of coins. Each card (55, 56 or 57) includes information or data readable from the card and identifying the card and further representing an amount corresponding to an allowable telephone call duration.

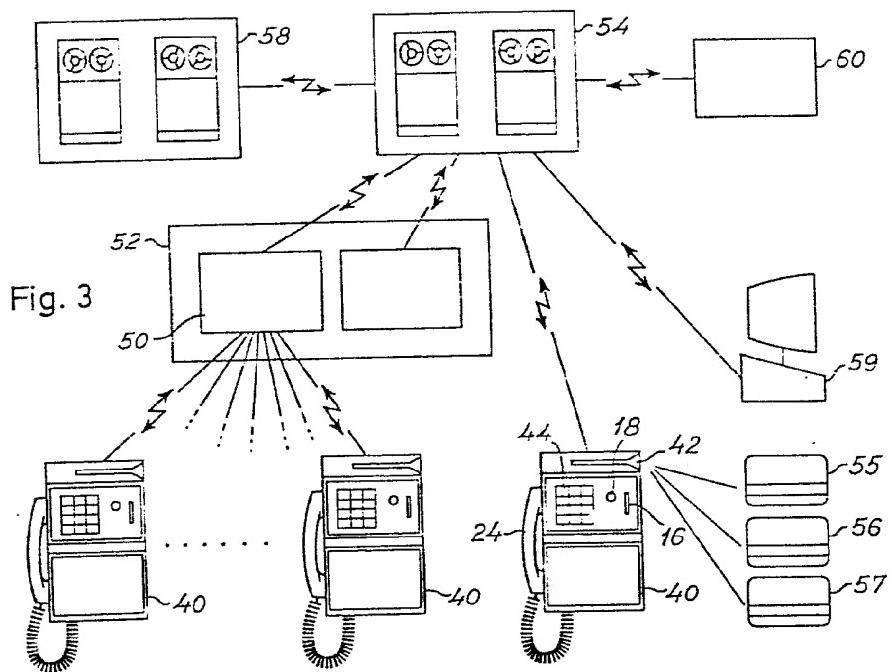
The pay phone system is operated in the following manner:

The card (55, 56 or 57) is received in a card receiving slot (42) in the apparatus (40) and the data of the card are read from the card and stored in a first storage means of the pay phone apparatus. The first storage means of the pay phone apparatus is addressable from the remote central computer (54) for transferring data stored in the first storage means to the remote central computer. In a second storage means of the pay phone apparatus, data transferred from the remote central computer (54) are stored. In a comparator means of the pay phone apparatus, the data read from the card and stored in the first storage means are compared to the data stored in the second storage means. By the comparison, the card is identified as a legal card or as an illegal card identified by the data of the second storage means. In case the card is

identified as an illegal card, the card is rejected from the pay phone apparatus. In case the card is identified as a legal card, a telephone call is permitted. In a debiting means, an amount corresponding to the duration of the telephone call is determined and in a subtraction means of the pay phone apparatus, the amount is subtracted from the data stored in the first storage means representing the amount corresponding to an allowable telephone call duration, and a reduced amount is generated and stored in the first storage means. When the amount determined by the debiting means exceeds the amount corresponding to the allowable telephone duration, the telephone call is interrupted. At the end of the telephone call, the data stored in the first storage means are written in the card by means of a writing means of the pay phone apparatus and identifies the card and further represents the reduced amount corresponding to an allowable telephone call duration.

Periodically, the remote central computer (54) addresses the first storage means of the individual pay phone apparatuses and transfers the data stored therein to the remote central computer for processing therein. On the basis of the data transferred from the first storage means of the individual pay phone apparatuses, the remote central computer updates the data of the second storage means of the individual pay phone apparatus.

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## A PAY PHONE SYSTEM OR A PAY SERVICE SYSTEM

The present invention relates to a pay phone system comprising at least one pay phone apparatus and a remote central computer, the pay phone apparatus communicating with a telephone central exchange 5 and further with the central computer through a telephone line.

For a great many years, pay phones have been known in which the individual pay phone apparatus is operated by means of coins as telephone calls have been paid for by inserting one or more coins in a slot or the pay phone apparatus. However, the appearance of credit 10 cards issued by credit card organisations, bank organisations, etc. have brought along a desire for a pay phone system, in which a token such as a credit card may be employed. Furthermore, the general trend towards the bill-, note- and coinless society has urged the desire for a pay phone system in which customer calls are paid 15 for by means of tokens such as magnetic cards basically of the conventional magnetic card configuration or a similar configuration. In the present context the phrase "token" is a generic expression for objects such as magnetic cards, magnetic strips, magnetic discs, optically readable cards, discs and strips or electronically readable 20 objects such as active electronic cards, chip cards, etc.

Pay phone systems in which the telephone apparatus is operated by means of a token of the above kinds have also been suggested in the art. However, the known pay phone systems are highly similar to known credit card systems in that the tokens employed in the pay 25 phone systems are personal cards issued to a particular person and in that the person in possession of such a card is requested to verify his legitimacy or authenticity by inputting into the pay phone apparatus a personal verification code or personal authenticity code such as a PIN-code (personal identification number-code) known to 30 the legitimate card possessor exclusively. In the system, the authenticity of the card is to be verified, and the authenticity of the person in possession of the card is further to be verified. It is, however, to be realized that this two-step verification procedure involves highly elaborate processing routines, which are normally carried out in an 35 on-line computer system. Transmission of data to and from the remote

central computer of the system for verifying the authenticity of the card and for verifying the authenticity of the person in possession of the card takes time due to telephone line transmission limitations, and the transmission actually occupies part of the telephone conversation  
5 time and is consequently to be considered as a loss of income to the telephone company. Common to these known pay phone systems is that the secrecy and security of the systems are linked to the secrecy and security of the individual cards which are further dependent on the secrecy and security of the individual authenticity and verification  
10 codes known by the legal card possessors exclusively.

The basis of the present invention is totally different from these well known pay phone systems of the credit card concept in that it is realized that token allowing for a telephone conversation is not a universal means of payment but a means of payment for a specific  
15 sort of goods and further of a limited value. Based on this realisation, a pay phone system of a concept highly different from the concept of the known telephone systems is provided.

In accordance with a first aspect of the present invention a pay phone system is provided, comprising:  
20 a means for receiving the token,  
a reading means for reading said readable data from the token received in the token receiving means,  
a writing means for writing data in the token,  
a first storage means connected to the reading means for storing  
25 data read from the token by the reading means, and further being connectable to the telephone line for transferring data to the remote central computer through the telephone line,  
a second storage means addressable from the remote central computer through the telephone line and for storing data transferred  
30 therefrom,  
a comparator means connected to the first storage means and the second storage means for comparing the data stored in the first storage means with the data stored in the second storage means so as to identify the token as a legal token, or alternatively, as an illegal

token and further for generating and supplying an accept signal to the telephone line in order to enable the pay phone apparatus for a telephone call, provided the token is identified as a legal token, or alternatively, for generating and supplying a reject signal to the receiving means, provided the token is identified as an illegal token, in order to make the receiving means reject the token, said accept signal, or alternatively, said reject signal being stored in the first storage means,

a debiting means for generating a signal representing a debiting amount corresponding to the duration of a telephone call,

a subtraction means connected to the first storage means and the debiting means and for subtracting the debiting signal from said amount represented by the data read from the token so as to reduce the amount, the reduced amount being stored in first storage means and further being output to the writing means and written in the said token by the writing means at the conclusion of the telephone call, and

a gate means connected to the subtraction means and being supplied with said reduced amount during the telephone call and for comparing the reduced amount and a predetermined threshold in order to interrupt the telephone call when the reduced amount falls below said predetermined threshold,

the pay phone apparatus being adapted to output data stored in the first storage means to the telephone line for transferring the data to the remote central computer for storing or processing therein after the conclusion of the telephone call; and

the remote central computer being adapted to transfer data identifying legal tokens and data identifying illegal tokens to the second storage means of the pay phone apparatus through the telephone line when the pay phone apparatus is not in operation.

In accordance with the concept of the present invention, the telephone call is made possible by means of a token, provided the token has been identified by the pay phone apparatus as a legal token, and provided the amount corresponding to an allowable telephone call duration is not below the predetermined threshold, i.e. normally larger than zero. Two particular points of the pay phone system concept of the present invention are to be underlined.

First, the identification of the token as a legal token is based on a comparison of data read from the token with data input to the second storage means of the pay phone apparatus from the remote central computer of the pay phone system. The data input to the second storage means by the pay phone apparatus, i.e. the data supplied from the remote central computer, may include positive verification data as well as negative verification data. Thus, the verification data stored in the second storage means may include data identifying false tokens or tokens tampered with such as tokens in which it has been attempted to alter the data stored in the token by rewriting data representing an amount larger than the amount written in the token at the conclusion of the latest telephone call. The processing of the data in the remote central computer very easily reveals tampering attempts of this kind by simply cross-checking data input from the individual pay phone apparatuses of the pay phone system regarding the individual tokens. In case it has been attempted to tamper with a token by increasing the amount represented by the data of the token, the token in question will be identified as an illegal token the data supplied to the second storage means of the pay phone apparatus from the remote central computer. It is to be understood that the data of the second storage means are updated at intervals and further that the security of the pay phone system may be altered, e.g. increased, by increasing the updating cycle and by adapted the processing of the data in the remote central computer to individual requirements.

Second, the transmission of data from the first storage means to the remote central computer and the transmission of data from the remote central computer to the second storage means of the pay phone apparatus do not occupy telephone conversation time. The data transmission to and from the remote central computer may be carried out at any appropriate time when the pay phone apparatus is not used, e.g. at low cost time such as by night and further in any appropriate cycle as discussed above.

In some applications, the pay phone apparatuses are arranged adjacent to one another such as in railway stations, airports, hospitals or

other public buildings, and a number of pay phone apparatuses may therefore in a pay phone system according to the present invention commonly comprise the first storage means, the second storage means and the comparator means, thus reducing the overall complexity of  
5 the system.

In accordance with a further aspect of the present invention, a pay phone system is provided comprising at least one pay phone apparatus, a local computer and a remote central computer, the pay phone apparatus communicating with a telephone central exchange and the  
10 local computer through a telephone line and further with the central computer through a data transmission line or a further telephone line, the pay phone apparatus being operated by means of a token including data readable from the token and identifying the token and further representing an amount corresponding to an allowable tele-  
15 phone call duration; the pay phone apparatus comprising:

a means for receiving the token,  
a reading means for reading said readable data from the token received in the token receiving means and connectable to the telephone line for transferring data to the local computer through the  
20 telephone line,

a writing means for writing data in the token and connectable to the telephone line for receiving data from the local computer through the telephone line,

a debiting means for generating a signal representing a debiting  
25 amount corresponding to the duration of a telephone call,

a subtraction means connected to the debiting means and for subtracting the debiting signal from said amount represented by the data read from the token so as to reduce the amount, the reduced amount being output to the writing means and written in the said  
30 token by the writing means at the conclusion of the telephone call,  
and

a gate means connected to the subtraction means and being supplied with said reduced amount during the telephone call and for comparing the reduced amount and a predetermined threshold in order  
35 to interrupt the telephone call when the reduced amount falls below said predetermined threshold;

the local computer comprising:

- a first storage means connectable to the telephone line for receiving data from the reading means of the pay phone apparatus through the telephone line, and for storing data read from the token by the
- 5 reading means of the pay phone apparatus, and further being connectable to the data transmission line or the further telephone line for transferring data to the remote central computer through the data transmission line or the further telephone line,
- a second storage means addressable from the remote central computer through the data transmission line or the further telephone line and for storing data transferred therefrom, and
- 10 a comparator means connected to the first storage means and the second storage means for comparing the data stored in the first storage means with the data stored in the second storage means so as
- 15 to identify the token as a legal token, or alternatively, as an illegal token and further for generating and supplying an accept signal to the telephone line in order to enable the pay phone apparatus for a telephone call, provided the token is identified as a legal token, or alternatively, for generating and supplying a reject signal to the
- 20 receiving means of the pay phone apparatus through the telephone line, provided the token is identified as an illegal token, in order to make the receiving means of the pay phone apparatus reject the token, said accept signal, or alternatively, said reject signal being stored in the first storage means;
- 25 the local computer being adapted to output data stored in the first storage means to the data transmission line or the further telephone line for transferring data to the remote central computer for storing or processing therein; and
- the remote central computer being adapted to transfer data identifying
- 30 legal tokens and data identifying illegal tokens to the second storage means of the local computer through the data transmission line or the telephone line.

In accordance with this aspect of the present invention, the first storage means, the second storage means and the comparator means

35 are contained in the local computer, whereas in the above first aspect of the present invention, the first storage means, the second storage

means and the comparator means are contained in the pay phone apparatus. The local computer may in accordance with this aspect of the present invention be arranged at the telephone central exchange. Furthermore, the two aspects of the present invention may be  
5 combined in a pay phone system.

Dependent on the arrangement of the local computer, the local computer may be assigned to a single pay phone apparatus or in accordance with a further embodiment of this aspect of the present invention be assigned to a plurality of pay phone apparatuses, e.g. assigned to a  
10 number of pay phone apparatuses of individual telephone booths of a railway station, an airport or the like.

In accordance with a further embodiment of the pay phone system according to the present invention, the pay phone apparatus is further adapted to be operated by means of a different token representing a credit token and being receivable in the receiving means of the pay phone apparatus and further including data readable from the token and identifying the token, the remote central computer being connected to or being connectable with a further computer of a credit organisation;  
15  
20 the comparator means further being adapted to identify the token as a credit token on the basis of the comparison of the data stored in the first storage means with the data stored in the second storage means and to address the first storage means so as to make the first storage means output the data stored therein to the telephone line for transferring the data to the remote central computer, provided the token has been identified as a credit token;  
25 the remote central computer further being adapted to address the further computer of the credit organisation when receiving data from the pay phone apparatus regarding the credit token and to transfer  
30 the data to the further computer in order to have the further computer verify the authenticity of the credit token, and, provided the credit token has been verified as a legal credit token by the further computer, to enable the pay phone apparatus for a telephone call;  
35 and the pay phone apparatus further being adapted to output the debiting signal generated by the debiting means during the telephone

- call to the telephone line for transferring therethrough to the central computer when enabled remotely;  
and the remote central computer further being adapted to transfer the debiting signal received from the pay phone apparatus to the further computer.

5       The debiting of the telephone call may be limited to an individual maximum limit controlled by the further computer or optionally be limited to a general maximum amount controlled by the remote central computer of the pay phone system.

- 10      Although the pay phone system concept of the present invention may be employed in connection with operator operated pay phone apparatuses or voice operated telephone systems, the pay phone apparatus of the pay phone system according to the present invention is preferably a direct dialling telephone apparatus. In the present context,  
15     the terms dial and dialling refer to the generation of signals addressing selector means at the telephone central by means of any appropriate dial or switch means, such as keyboards, dials or the like. Consequently, the pay phone apparatus of the pay phone system preferably comprises a dial means including manually operable switch means  
20     for generating a sequence of tone burst signals and for supplying the sequence to the telephone exchange through the telephone line for addressing selector means of the telephone exchange.

- 25      The teaching of the present invention further renders it possible to adapt the pay phone system into an operational mode in which a telephone subscriber is called and asked if he will accept to pay for the telephone call by providing the pay phone apparatus in an embodiment further comprising a further manually operable switch means and a voice generator means, the further manually operable switch means being connected to the voice generator means and adapted to activate  
30     the latter, the first storage means further being adapted to store the sequence of tone burst signals generated by means of the manually operable switch means of the dial means, the voice generator means being adapted to generate a request signal and being connectable to the telephone lines so as to generate and supply the request signal to

the telephone line which is activated by the further manually operable switch means, the request signal being further transmitted to the telephone subscriber addressed by the sequence of tone burst signals generated by means of the manually operable switch means of the dial means, and the pay phone apparatus further being adapted to be enabled for the telephone call by an accept signal supplied to the pay phone apparatus from the telephone subscriber apparatus in response to the request signal.

In this embodiment, an accept signal supplied to the telephone apparatus from the telephone subscriber apparatus may be generated in any appropriate manner, e.g. by means of a dial means of the telephone subscriber apparatus, as the request signal may ask the telephone subscriber to activate the dial means of his telephone apparatus in a prescribed manner, i.e. to dial a number mentioned in the request.

Like conventional telephone apparatuses, the telephone apparatus of the pay phone system according to the present invention may further comprise a receiver means including at least two electro-acoustic transducers one of which is adapted to convert acoustic energy into electric energy and to supply said acoustic energy to the telephone line when the pay phone apparatus is in operation, and another one of which is adapted to receive electric energy from the telephone line and convert the electric energy into acoustic energy when the pay phone apparatus is in operation.

Alternatively, the electro-acoustic transducers may be included in an optional or accessory apparatus connected to the pay phone apparatus, e.g. be included in a conventional coin operated telephone apparatus which is further connected to the token operated pay phone apparatus of the pay phone system according to the present invention.

In the above embodiment of the pay phone system according to the invention, the first storage means and the second storage means of the pay phone apparatus may be constituted by individual storage

means fulfilling any appropriate requirements. However, in an alternative embodiment, the first storage means and the second storage means of the pay phone apparatus are constituted by first and second parts, respectively, of a single storage means. In order to guarantee  
5 that the data stored in the second storage means of the pay phone apparatus, i.e. the data input from the remote central computer representing data including empirical experience collected through the anterior period of time is not lost in case the pay phone apparatus of the pay phone system is disconnected from the supply, i.e. from the  
10 telephone line, the second storage means of the pay phone apparatus is preferably constituted by a non-volatile store such as a E<sup>2</sup>-PROM (electrically erasable programmable read only memory) whereas the first storage means of the pay phone apparatus may be constituted by a non-volatile or, preferably, a volatile store, such as a RAM  
15 (random access memory).

As will be evident from the discussion above and further from the detailed description below, the pay phone apparatus of the pay phone system according to the invention is basically an autonomic unit operating substantially independently of the remote central computer  
20 as the verification of the token is carried out in the pay phone apparatus on the basis of the comparison of the data input token and the data previously supplied to the pay phone apparatus from the remote central computer. In accordance with the preferred embodiment of the pay phone apparatus of the pay phone system according to the  
25 invention, the pay phone apparatus further comprises a central control means controlling the overall operation of the apparatus. The central control means of the pay phone apparatus may preferably be constituted by a micro-computer means.

The pay phone system may preferably further comprise encryption  
30 and/or decryption means in order to transfer data to and from the first storage means and the second storage means of the pay phone apparatus and optionally further transmit data from and to the reading means and the writing means of the pay phone apparatus in an encrypted state. By transmitting the data in an encrypted state, it is  
35 prevented that a criminal may gain access to the verification data

stored in the second storage means of the pay phone apparatus by tampering with the pay phone apparatus. In a first embodiment of the pay phone system including encryption and/or decryption means within the pay phone apparatus, a decryption means is included in  
5 the pay phone apparatus for decrypting data read from the token received in the token receiving means by means of the reading means and further for decrypting data output from the second storage means of the pay phone apparatus. Consequently, the data stored in the token are provided in an encrypted state and the data transferred  
10 from the remote central computer to the second storage means of the pay phone apparatus are also provided in an encrypted state. The decryption means may further or alternatively be adapted to decrypt the data output from the first storage means which renders it possible to have the data stored in the first storage means in an encrypted  
15 state. In a further or alternative embodiment of the pay phone system further comprising encryption and decryption means, an encryption means is interconnected between the first storage means and the telephone line, and a decryption means is interconnected between the telephone line and the second storage means, for supplying the data  
20 output from the first storage means to the telephone line in an encrypted state, and for decrypting the data transferred from the remote central computer to the second storage means from an encrypted state to a decrypted state, respectively.

In order to inform a person operating the telephone apparatus of the  
25 telephone system as to the operational state of the system and further the amount consumed from the original amount represented by the data read from the token, the pay phone apparatus may preferably comprise a display means connected to the comparator means, to the subtraction means and to the gate means for displaying information  
30 corresponding to the accept signal, or alternatively, the reject signal supplied from the comparator means, for displaying said amount supplied from the subtraction means, and further for displaying information supplied from the gate means.

The token or tokens operating the pay phone system according to the  
35 present invention may as discussed above be any of the above tokens

including data readable from the token and further rendering it possible to write data in the token. Since the tokens are so to speak consumed by the reduction of the amount represented by data read from the token and are consequently converted into objects of no value, the token in itself is preferably of a construction and configuration representing an extremely low price. An example of a token representing a low price is the magnetic card. Consequently, the token to be employed in connection with the pay phone system according to the invention is preferably a card having a strip of a magnetic material arranged at one side surface of the card, the reading and writing means of the pay phone apparatus being magnetic reading and writing means, respectively.

Apart from providing a token at an extremely low cost by providing the token as a magnetic card, the pay phone system is further made compatible with the conventional magnetic cards issued by credit card organisations, etc. The magnetic card to be employed in connection with the pay phone system according to the present invention is preferably of the concept described in the Applicants' co-pending PCT-application PCT/DK84/00118, in which a magnetic recording member, preferably a magnetic card having a two-part or two-layer magnetic carrier, is described. By providing a two-part two-layer magnetic information carrier in which the two parts or the two layers together constitute a basically homogeneous magnetic part or layer, and in which the first part or first layer includes an original information e.g. the original amount written on the card, and in which the second part or second layer is to be recorded with additional information representing the "consumption" of the amount, a tamper-proof token is provided as it is rendered impossible to alter the additional information without tampering with the original information so that any tampering attempts are very easily detected. The magnetic card to be employed in connection with the pay phone system of the present invention is preferably further conform or basically conform to the ISO 2894 Standard regarding magnetic cards.

The present invention further relates to a pay phone apparatus having any of the above characteristics.

Furthermore, it is believed that the concept of the present invention is advantageously employed in connection with a pay service system, e.g. in connection with transport vehicles, such as buses, taxis, trains, aeroplanes, ferries, etc. and further in any other situation in  
5 which a customer pays for a service.

Thus, still a further aspect of the present invention relates to a pay service system comprising at least one pay service apparatus and a remote central computer, the pay service apparatus communicating with the central computer through a transmission line, the pay  
10 service apparatus being operated by means of a token including data readable from the token and identifying the token and further representing an amount corresponding to an allowable service performance; the pay service apparatus comprising:

- 15      a means for receiving the token,
- 20      a reading means for reading said readable data from the token received in the token receiving means,
- 25      a writing means for writing data in the token,
- 30      a first storage means connected to the reading means for storing data read from the token by the reading means, and further being connectable to the transmission line for transferring data to the remote central computer through the telephone line,
- 35      a second storage means addressable from the remote central computer through the telephone line and for storing data transferred therefrom,
- 40      a comparator means connected to the first storage means and the second storage means for comparing the data stored in the first storage means with the data stored in the second storage means so as to identify the token as a legal token, or alternatively, as an illegal token and further for generating an accept signal in order to enable the pay service apparatus for a service performance, provided the token is identified as a legal token, or alternatively, for generating and supplying a reject signal to the receiving means, provided the token is identified as an illegal token, in order to make the receiving means reject the token, said accept signal, or alternatively, said reject signal being stored in the first storage means,

- a debiting means for generating a signal representing a debiting amount corresponding to the duration of a service performance,
- 5 a subtraction means connected to the first storage means and the debiting means and for subtracting the debiting signal from said amount represented by the data read from the token so as to reduce the amount, the reduced amount being stored in the first storage means and further being output to the writing means and written in the said token by the writing means at the conclusion of the service performance, and
- 10 a gate means connected to the subtraction means and being supplied with said reduced amount during the service performance and for comparing the reduced amount and a predetermined threshold in order to interrupt the service performance when the reduced amount falls below said predetermined threshold;
- 15 the pay service apparatus being adapted to output data stored in the first storage means to the transmission line for transferring the data to the remote central computer for storing or processing therein after the conclusion of the service performance; and
- 20 the remote central computer being adapted to transfer data identifying legal tokens and data identifying illegal tokens to the second storage means of the pay service apparatus through the transmission line when the pay service apparatus is not in operation.

The present invention will now be further described with reference to the drawings, in which

- 25 Fig. 1 is a perspective and schematical view of a pay phone apparatus of a pay phone system according to the present invention connected to a conventional coin operated pay phone apparatus,
- Fig. 2 is a perspective and schematical view of a presently preferred embodiment of a pay phone apparatus according to the present invention,
- 30 Fig. 3 is an overall block diagram view of the pay phone system concept of the present invention,
- Fig. 4 is an overall block diagram illustrating the individual blocks of the presently preferred embodiment of the pay phone apparatus
- 35 according to the presently preferred invention, and

Fig. 5 is a route diagram illustrating the verification routine of the above presently preferred embodiment of the pay phone apparatus according to the invention.

In Fig. 1, a first embodiment of the pay phone apparatus of a pay phone system according to the invention is shown. The apparatus is an auxiliary apparatus designated 10 and connected to a conventional coin operated pay phone apparatus 12. The apparatus 12 comprises a housing 14, in which a coin container (not shown in the drawing) is enclosed. On the upper front surface of the housing 14, a coin receiving slot 16 is provided together with a return pushbutton 18 and a dial means 20. In a recess 22 at the left-hand side of the housing 14, a receiver 24 is received on a hook of the apparatus including switching means for turning the apparatus into operation. The receiver 24 is connected to the housing 14 through a coiled cord 26. On the lower front surface of the house 14, a plate informs an operator how to use the telephone apparatus.

The auxiliary apparatus 10 comprises a housing 28 and is operated by means of a magnetic card which is received in a magnetic card receiving slit 30 on the front surface of the apparatus housing 24. The auxiliary apparatus 10 further comprises a display 32 arranged at the upper end of the front surface of the housing 28 and further two manually operable buttons 33 and 34 serving the purpose of switching the pay phone apparatus assembly comprising the auxiliary apparatus 10 and the coin operated pay phone apparatus 12 into an operational mode in which the telephone call is paid for by the telephone subscriber to whom the telephone call is addressed. This mode of receiving telephone subscriber paying the telephone call is to be described in greater detail below with reference to Fig. 4.

In Fig. 2 a presently preferred embodiment of a pay phone apparatus of a pay phone system according to the present invention is shown. The pay telephone apparatus is designated 40 in its entirety and comprises the above housing 14 and the receiver 24 received in the recess 22 of the housing 14 and further connected through the cord 26 to the housing 14. Instead of the coin receiving slot 16, the dial

means 20 and the return pushbutton 18, the embodiment shown in Fig. 2 comprises a card receiving slit 42 basically identical to the slit 30 shown in Fig. 1, a keyboard dial means 44, a display 46 basically corresponding to the display 32 shown in Fig. 1 and two pushbuttons 48 and 49 basically corresponding to the pushbuttons 33 and 34 shown in Fig. 1. The operation of the apparatus 40 will be evident from the detailed description below with reference to Fig. 4.

- In Fig. 3, a schematical view of a pay phone system according to the present invention is shown. The system comprises a number of pay 10 phone apparatuses 40, e.g. of the type shown in Fig. 2, which are connected through telephone lines to a local computer 50, e.g. at the telephone central 52, and which are further connected to a remote central computer 54, to which one of the pay phone apparatuses 40 is connected directly. The pay phone apparatuses 40 are operated by 15 means of magnetic cards 55, 56, and 57, preferably of the kind described in Applicants' co-pending PCT-application PCT/DK84/00118 and basically conform to ISO Standard 2894. Apart from the magnetic cards issued by the telephone company, the pay telephone apparatuses 40 may be operated by means of a magnetic card issued by a 20 credit card organisation. In Fig. 3, a computer system of a first credit card organisation is shown at 58 and a second computer system of a second credit card organisation is shown at 60. The remote central computer 54 further communicates through a telephone line with a terminal 59, e.g. a terminal at a telephone shop.
- 25 A telephone apparatus 40 (at the lower right-hand side of Fig. 3) which communicates with the remote central computer 54 directly, includes a storage means as will be described in greater detail below with reference to Figs. 4 and 5, and which is addressed from the remote central computer 54 and includes data identifying legal 30 magnetic cards and illegal magnetic cards.

When a magnetic card, e.g. the card 55 shown in Fig. 1 is input into the magnetic card receiving slit 42 of the pay phone apparatus 40, the data stored in the magnetic strip on the card is read from the card and input to a storage means of the pay phone apparatus. The

- data read from the magnetic card and the data transferred from the remote central computer 54 to the above storage means of the pay phone apparatus are compared, and on the basis of the comparison, the card is identified as a legal card, or alternatively, as an illegal
- 5 card, and it is further checked if the amount represented by data read from the card and representing a maximum telephone call duration is different from zero and has not been altered to a value exceeding the value written in the magnetic card at the conclusion of the preceding telephone call paid for by means of the card in question.
- 10 Provided the card is identified as a legal card and further a card allowing for a telephone call in that the amount is different from zero and has not been altered to a higher value, the pay phone apparatus is enabled for a telephone call, and the operator is through the display means 46 of the apparatus, *vide* Fig. 2, invited to input a
- 15 telephone number by means of the keyboard dial means 44. Provided the total amount read from the card 55 is not reduced to zero during the telephone call, the reduced amount is written in the card at the conclusion of the telephone call prior to the returning of the card to the operator from the magnetic card receiving slit 42.
- 20 The reduced amount of the card is stored in the apparatus and at a later time transferred to the remote central computer 54, in which the data are processed, the data are cross-checked relative to data input from other pay phone apparatuses and from local computers such as the local computer 50, and on the basis of the data processing in the
- 25 remote central computer 54, any illegal cards i.e. cards which have been altered or otherwise tampered with are identified, and data identifying these cards are output from the remote central computer 54 to the storage means of the individual pay phone apparatus 40.

The pay phone apparatuses at the left hand-side of Fig. 3 are connected to a local computer 50, which includes the storage means which is addressed from the remote central computer 54 and includes data identifying legal and illegal cards, and further the storage means into which the data read from the cards 55-57 are stored, together with the comparison block in which the data read from the card and the

data previously supplied from the remote central computer 54 are compared to one another in order to identify the card in question as a legal or as an illegal card.

- In case a card issued by a credit card organisation, e.g. the credit
- 5 card organisation running the computer system 58, is input to the pay phone apparatus 40, the data read from the card identifies the card as a credit card, and the pay phone apparatus addresses the remote central computer 54, which further addresses the credit card computer system in which the authenticity of the card is verified.
- 10 Provided the authenticity of the card issued by the credit card organization is verified, the pay phone apparatus 40 is enabled for a telephone call, i.e. the operator is invited to input a telephone number by means of the keyboard dial means 44 as discussed above. The data read from the card issued by the credit card organization is
- 15 stored in the pay phone apparatus together with the amount representing the telephone call duration and at a later time when the data stored in the pay phone apparatus are transferred to the remote central computer 54, and further transferred therefrom to the computer system 50 so as to debit the telephone call to the credit card
- 20 account corresponding to the credit card employed for the telephone call. The remote central computer 54 may be adapted to automatically limit the duration of the telephone call to a predetermined value.

- The terminal 59 renders it possible to check the history of a particular card by addressing the remote central computer 54 in order to
- 25 check a complaint regarding a magnetic card.

In Fig. 4, a block diagram of the pay phone apparatus 40 is shown. The apparatus comprises centrally a microprocessor 62, which controls the overall operation of the apparatus and is connected to the individual block of the apparatus to be described below. The microprocessor 62 is connected to the keyboard dial means 44, the display 46 and an audio-circuit block 64, to which the receiver 24 is connected. The microprocessor 62 is further connected to a magnetic reading and writing block 66 including the magnetic card receiving slit 42, a magnetic reading head 67, a magnetic writing head 68 and magnetic

card advancing pulleys 69 and 70 which may be idler or drive pulleys or combined idler and drive pulleys. The microprocessor 62 is also connected to a voice generator block 72, which is further connected to a block 74 including the pushbuttons 48 and 49, which activate switches of the block 74. Furthermore, the microprocessor 62 is connected to a first store 76, into which data read from a card by means of the magnetic reading head 67 are input through the microprocessor 62, and further to a second store 78, into which data identifying legal and illegal parts are input from the remote central computer 54 shown in Fig. 3 through an input/output interface block 82 connected to a telephone line and further through an encryption/decryption block 80. Alternatively, a decryption block may be included in the microprocessor 62 so that data transferred from the remote central computer 54 shown in Fig. 3 to the second store 78 of the pay phone apparatus 40 are in an encrypted state and so that the data read from the magnetic card or cards, e.g. the cards 55, 56 and 57 shown in Fig. 3 are further in an encrypted state and are stored in the first store 76 in an encrypted state. Consequently, a criminal who attempts to disclose the inherent information stored in the stores 76 and 78 by tampering with the pay phone apparatus 40 is not able to obtain any relevant information regarding the pay phone system as the data stored in the stores 76 and 78 are in an encrypted state. As will be appreciated, the data transferred to and from the individual blocks of the apparatus, i.e. to and from the reading and writing block 66 and to and from the stores 76 and 78 and further transferred to the apparatus or from the apparatus through the telephone line are in an encrypted state. Within the microprocessor 62, the data are disclosed in a plain text exclusively.

In the normal operational mode of the apparatus, data read from cards received in the magnetic card receiving slit 42 are input to the first store 76 and stored therein and further compared to data stored in the second store 78 and representing legal and illegal cards. On the basis of the comparison, it is determined whether the card is a legal card or not. Provided the card is identified as a legal card and the amount allowing for a telephone call and read from the card is an amount larger than zero, the pay phone apparatus is enabled for a

telephone call. The operator is informed by means of the display 46 to input a telephone number by means of a keyboard dial means 44. The telephone number dialled is displayed on the display 46 and as the connection is established, the display 46 is switched into displaying 5 the amount allowing for the telephone call. The amount is gradually reduced, and the reduced amount is displayed to the operator on the display 46. At the conclusion of a telephone call, the reduced amount is written into the magnetic card by means of the writing head 68 of the block 66. In case the amount is reduced to zero prior to the 10 conclusion of the telephone call, the pay phone apparatus automatically interrupts the telephone call, and the reduced amount, i.e. the amount zero is written into the magnetic card, which is consequently converted into a valueless card.

In an alternative operational mode, the operator activates one of the 15 pushbuttons 48 and 49, which further activates the voice generator block 72 and the microprocessor 62 and converts the apparatus into an operational mode, in which the telephone call is to be debited to the telephone subscriber receiving the telephone call. Having activated the pushbutton in question, i.e. one of the pushbuttons 48 and 49, the operator is invited to dial the telephone number by means 20 of the keyboard dial means 44 the telephone number being stored in the first store 76, and as the connection has been established, the voice generator block 72 outputs an audio signal to the telephone line asking the telephone subscriber receiving the telephone call, if he 25 will accept to pay for the telephone call. If the telephone subscriber is willing to accept to pay for the telephone call, he activates the dial means of his telephone apparatus in a prescribed manner, i.e. he dials a number asked for by the signal generated by the voice generator block 72 by means of the dial means of his telephone apparatus in order to generate a sequence of a tone burst signals 30 which are supplied through the telephone line to the pay phone apparatus. The amount representing the telephone call duration is also stored in the first store 76 and at a later time, when the data of the store 76 are transferred to the remote central computer 54, 35 debited the account of the telephone subscriber.

In Fig. 5, the verification routine carried out in the pay phone apparatus 40 or alternatively in the auxiliary apparatus 10 connected to the conventional coin operated pay phone apparatus is illustrated in a route diagram. Data read from the card 55 identifying the card, e.g. by its number or the like, are compared to data output from the store 78 in a verification block 84. Data read from the card 55 and representing an amount allowing for a telephone call are compared to data output from the store 76 in a further verification block 86. Provided the verification blocks 84 and 86 identify the card 55 as a legal and not totally consumed card, respectively, a further logical decision block 88 enables the pay phone apparatus for a telephone call.

As described above, the operator is invited to dial a telephone number by means of the keyboard dial means 44. The keyboard dial means 44 further activates a debiting pulse generator block 90, which supplies debiting pulses to an arithmetic block 92, which further receives the amount read from the card 55 and reduces the amount in response to the debiting pulses supplied from the debiting pulse generator block 90.

The actual or reduced amount is displayed on the display 46 and input to the store 76 and further supplied to the block 94, which is adapted to interrupt the telephone conversation as the amount is reduced below a predetermined threshold, such as a zero threshold. At the conclusion of the telephone call, the store 76 outputs the reduced amount to the magnetic writing head 68 shown in Fig. 4 by means of which the amount is written in the card 55. Through the telephone line connected to the telephone exchange and also to the remote central computer 54 shown in Fig. 3, the data stored in the store 76 are output to the remote central computer at an appropriate time, e.g. by night, and in the remote central computer, the data are processed as described above, and the data stored in the store 78 and identifying legal and illegal cards are updated in response to the processing of the data in the remote central computer.

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In the description above, an integral pay phone apparatus has been described. In the embodiment shown in the lower left-hand side of Fig. 3, the store 76, the store 78, the verification block 84, the verification block 86, the logical decision block 88 and the microprocessor 62 controlling the overall operation of the apparatus are housed in the local computer 50.

5 In a further alternative embodiment, a number of pay phone apparatuses of the type shown in the lower right-hand side of Fig. 3 may commonly comprise the above identified controlling, storing and decision blocks, e.g. in applications in which a number of pay phone apparatuses are arranged in adjacent telephone booths, e.g. at railway stations, airports, etc.

10 Although the concept of making the telephone subscriber pay for the telephone call has been described in connection with the pay phone apparatus of the pay phone system according to the invention, it is, however, believed that the receiving subscriber paying principle may be adapted to other telephone apparatuses such as conventional telephone subscriber apparatuses and is a universally applicable debiting principle.

## CLAIMS

1. A pay phone system comprising at least one pay phone apparatus and a remote central computer, the pay phone apparatus communicating with a telephone central exchange and further with the central computer through a telephone line, the pay phone apparatus being operated by means of a token including data readable from the token and identifying the token and further representing an amount corresponding to an allowable telephone call duration; the pay phone apparatus comprising:
  - 5        a means for receiving the token,
  - 10      a reading means for reading said readable data from the token received in the token receiving means,
  - a writing means for writing data in the token,
  - 15      a first storage means connected to the reading means for storing data read from the token by the reading means, and further being connectable to the telephone line for transferring data to the remote central computer through the telephone line,
  - 20      a second storage means addressable from the remote central computer through the telephone line and for storing data transferred therefrom,
  - 25      a comparator means connected to the first storage means and the second storage means for comparing the data stored in the first storage means with the data stored in the second storage means so as to identify the token as a legal token, or alternatively, as an illegal token and further for generating and supplying an accept signal to the telephone line in order to enable the pay phone apparatus for a telephone call, provided the token is identified as a legal token, or alternatively, for generating and supplying a reject signal to the receiving means, provided the token is identified as an illegal token,
  - 30      in order to make the receiving means reject the token, said accept signal, or alternatively, said reject signal being stored in the first storage means,
- a debiting means for generating a signal representing a debiting amount corresponding to the duration of a telephone call,

a subtraction means connected to the first storage means and the debiting means and for subtracting the debiting signal from said amount represented by the data read from the token so as to reduce the amount, the reduced amount being stored in first storage means and further being output to the writing means and written in the said token by the writing means at the conclusion of the telephone call, and

5 a gate means connected to the subtraction means and being supplied with said reduced amount during the telephone call and for 10 comparing the reduced amount and a predetermined threshold in order to interrupt the telephone call when the reduced amount falls below said predetermined threshold;

the pay phone apparatus being adapted to output data stored in the first storage means to the telephone line for transferring the data to 15 the remote central computer for storing or processing therein after the conclusion of the telephone call; and

the remote central computer being adapted to transfer data identifying legal tokens and data identifying illegal tokens to the second storage means of the pay phone apparatus through the telephone line when 20 the pay phone apparatus is not in operation.

2. A pay phone system according to claim 1, a number of pay phone apparatuses commonly comprising the first storage means, the second storage means, and the comparator means.

3. A pay phone system comprising at least one pay phone apparatus, 25 a local computer and a remote central computer, the pay phone apparatus communicating with a telephone central exchange and the local computer through a telephone line and further with the central computer through a data transmission line or a further telephone line, the pay phone apparatus being operated by means of a token including data readable from the token and identifying the token and further representing an amount corresponding to an allowable telephone call duration; the pay phone apparatus comprising:

a means for receiving the token,

a reading means for reading said readable data from the token received in the token receiving means and connectable to the tele-

phone line for transferring data to the local computer through the telephone line,

5        a writing means for writing data in the token and connectable to the telephone line for receiving data from the local computer through the telephone line,

      a debiting means for generating a signal representing a debiting amount corresponding to the duration of a telephone call,

10      a subtraction means connected to the debiting means and for subtracting the debiting signal from said amount represented by the data read from the token so as to reduce the amount, the reduced amount being output to the writing means and written in the said token by the writing means at the conclusion of the telephone call, and,

15      a gate means connected to the subtraction means and being supplied with said reduced amount during the telephone call and for comparing the reduced amount and a predetermined threshold in order to interrupt the telephone call when the reduced amount falls below said predetermined threshold;

      the local computer comprising:

20      a first storage means connectable to the telephone line for receiving data from the reading means of the pay phone apparatus through the telephone line, and for storing data read from the token by the reading means of the pay phone apparatus, and further being connectable to the data transmission line or the further telephone line for transferring data to the remote central computer through the data transmission line or the further telephone line,

25      a second storage means addressable from the remote central computer through the data transmission line or the further telephone line and for storing data transferred therefrom, and

30      a comparator means connected to the first storage means and the second storage means for comparing the data stored in the first storage means with the data stored in the second storage means so as to identify the token as a legal token, or alternatively, as an illegal token and further for generating and supplying an accept signal to the telephone line in order to enable the pay phone apparatus for a telephone call, provided the token is identified as a legal token, or

- alternatively, for generating and supplying a reject signal to the receiving means of the pay phone apparatus through the telephone line, provided the token is identified as an illegal token, in order to make the receiving means of the pay phone apparatus reject the  
5 token, said accept signal, or alternatively, said reject signal being stored in the first storage means;
- the local computer being adapted to output data stored in the first storage means to the data transmission line or the further telephone line for transferring data to the remote central computer for storing  
10 or processing therein; and
- the remote central computer being adapted to transfer data identifying legal tokens and data identifying illegal tokens to the second storage means of the local computer through the data transmission line or the telephone line.
- 15 4. A pay phone system according to claim 2, the local computer being assigned to a plurality of pay phone apparatuses.
5. A pay phone system according to any of the preceding claims, the pay phone apparatus further being adapted to be operated by means of a different token representing a credit token and being receivable  
20 in the receiving means of the pay phone apparatus and further including data readable from the token and identifying the token, the remote central computer being connected to or being connectable with a further computer of a credit organisation;
- the comparator means further being adapted to identify the token as a  
25 credit token on the basis of the comparision of the data stored in the first storage means with the data stored in the second storage means and to address the first storage means so as to make the first storage means output the data stored therein to the telephone line for transferring the data to the remote central computer, provided the token  
30 has been identified as a credit token;
- the remote central computer further being adapted to address the further computer of the credit organisation when receiving data from the pay phone apparatus regarding the credit token and to transfer the data to the further computer in order to have the further computer  
35 verify the authenticity of the credit token, and, provided the

- credit token has been verified as a legal credit token by the further computer, to enable the pay phone apparatus for a telephone call; and the pay phone apparatus further being adapted to output the debiting signal generated by the debiting means during the telephone
- 5 call to the telephone line for transferring therethrough to the central computer when enabled remotely; and the remote central computer further being adapted to transfer the debiting signal received from the pay phone apparatus to the further computer.
- 10 6. A pay phone system according to any of the preceding claims, the pay phone apparatus further comprising a dial means including manually operable switch means for generating a sequence of tone burst signals and for supplying the sequence to the telephone central exchange through the telephone line for addressing selector means of
- 15 the telephone central exchange.
7. A pay phone system according to claim 6, the pay phone apparatus further comprising a further manually operable switch means and a voice generator means, the further manually operable switch means being connected to the voice generator means
- 20 and adapted to activate the latter, the first storage means further being adapted to store the sequence of tone burst signals generated by means of the manually operable switch means of the dial means, the voice generator means being adapted to generate a request signal and being connectable to the telephone line so as to generate and
- 25 supply the request signal to the telephone line when activated by the further manually operable switch means, the request signal being further transmitted to the telephone subscriber addressed by the sequence of tone burst signals generated by means of the manually operable switch means of the dial means, and the pay phone
- 30 apparatus further being adapted to be enabled for the telephone call by an accept signal supplied to the pay phone apparatus from the telephone subscriber apparatus in response to the request signal.

8. A pay phone system according to any of the preceding claims, the pay phone apparatus further comprising a receiver means including at least two electro-acoustic transducers one of which is adapted to convert acoustic energy into electric energy and to supply said acoustic energy to the telephone line when the pay phone apparatus is in operation, and another one of which is adapted to receive electric energy from the telephone line and convert the electric energy into acoustic energy, when the pay phone apparatus is in operation.
- 5
9. A pay phone system according to any of the preceding claims, the first storage means and the second storage means of the pay phone apparatus being constituted by first and second parts, respectively, of a single storage means.
- 0
10. A pay phone system according to any of the preceding claims, the first storage means of the pay phone apparatus being constituted by a volatile store, and a second storage means of the pay phone apparatus being constituted by the non-volatile store.
- 5
11. A pay phone system according to any of the preceding claims, the pay phone apparatus further comprising a central control means controlling the overall operation of the apparatus.
- 20
12. A pay phone system according to claim 11, the central control means of the pay phone apparatus being constituted by a micro computer means.
- 25
13. A pay phone system according to any of the preceding claims, the pay phone system further comprising encryption and decryption means, an encryption means being interconnected between the first storage means and the telephone line and a decryption means being interconnected between the telephone line and the second storage means, for supplying the data output from the first storage means to the telephone line in an encrypted state, and for decrypting the data transferred from the remote central computer to the second storage means from an encrypted state to a decrypted state, respectively.
- 30

14. A pay phone system according to any of the preceding claims, the pay phone apparatus further comprising a display means connected to the comparator means, to the subtraction means and to the gate means for displaying information corresponding to the accept signal, or  
5 alternatively, the reject signal supplied from the comparator means, for displaying said amount supplied from the subtraction means, and further for displaying information supplied from the gate means.
15. A pay phone system according to any of the preceding claims, the token being a card having a strip of a magnetic material arranged at one side surface of the card, the reading and writing means of the pay phone apparatus being magnetic reading and writing means, respectively.  
10
16. A pay phone apparatus having any of the characteristics of the pay phone apparatus of the pay phone system according to any of the claims 1-15.  
15
17. A pay service system comprising at least one pay service apparatus and a remote central computer, the pay service apparatus communicating with the central computer through a transmission line, the pay service apparatus being operated by means of a token including data readable from the token and identifying the token and further representing an amount corresponding to an allowable service performance; the pay service apparatus comprising:  
20
- a means for receiving the token,
  - a reading means for reading said readable data from the token received in the token receiving means,  
25
  - a writing means for writing data in the token,
  - a first storage means connected to the reading means for storing data read from the token by the reading means, and further being connectable to the transmission line for transferring data to the remote central computer through the telephone line,  
30
  - a second storage means addressable from the remote central computer through the telephone line and for storing data transferred therefrom,

a comparator means connected to the first storage means and the second storage means for comparing the data stored in the first storage means with the data stored in the second storage means so as to identify the token as a legal token, or alternatively, as an illegal token and further for generating an accept signal in order to enable the pay service apparatus for a service performance, provided the token is identified as a legal token, or alternatively, for generating and supplying a reject signal to the receiving means, provided the token is identified as an illegal token, in order to make the receiving means reject the token, said accept signal, or alternatively, said reject signal being stored in the first storage means,

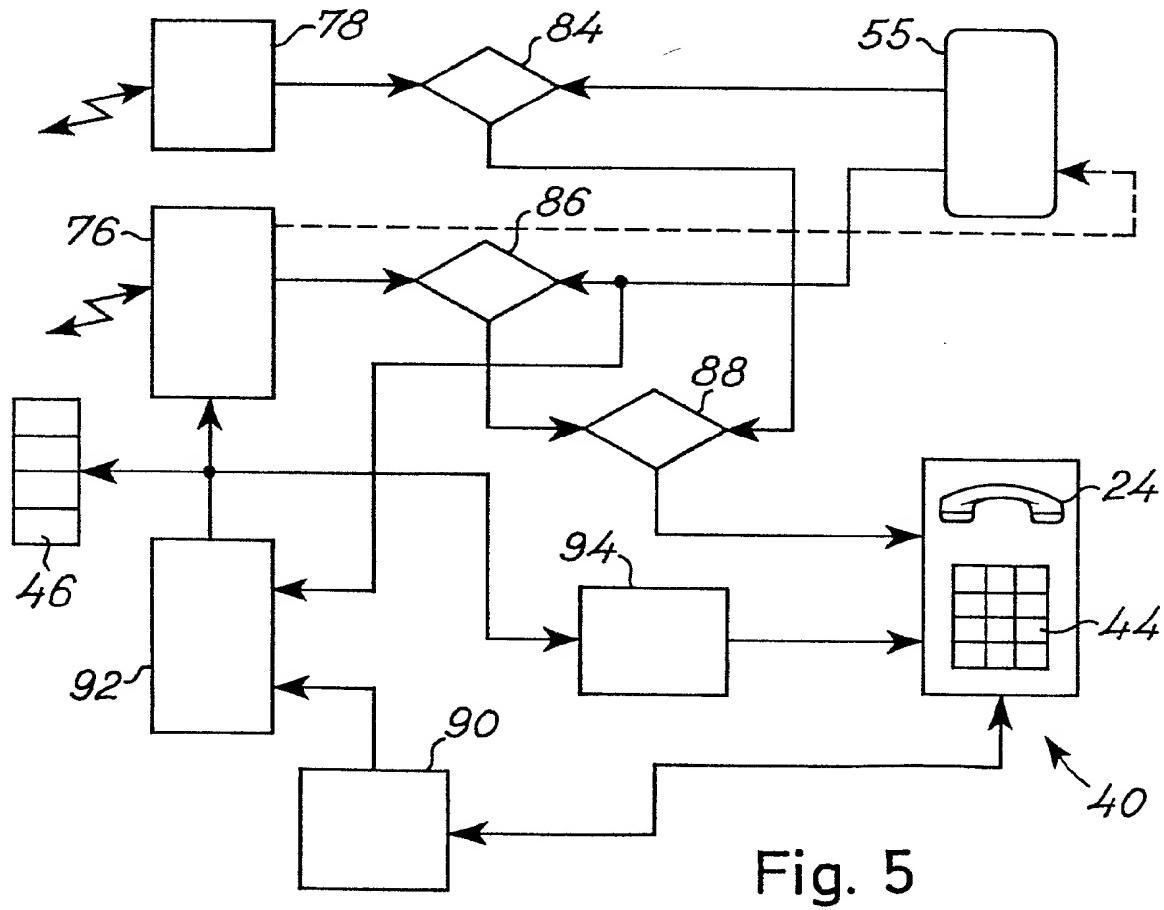
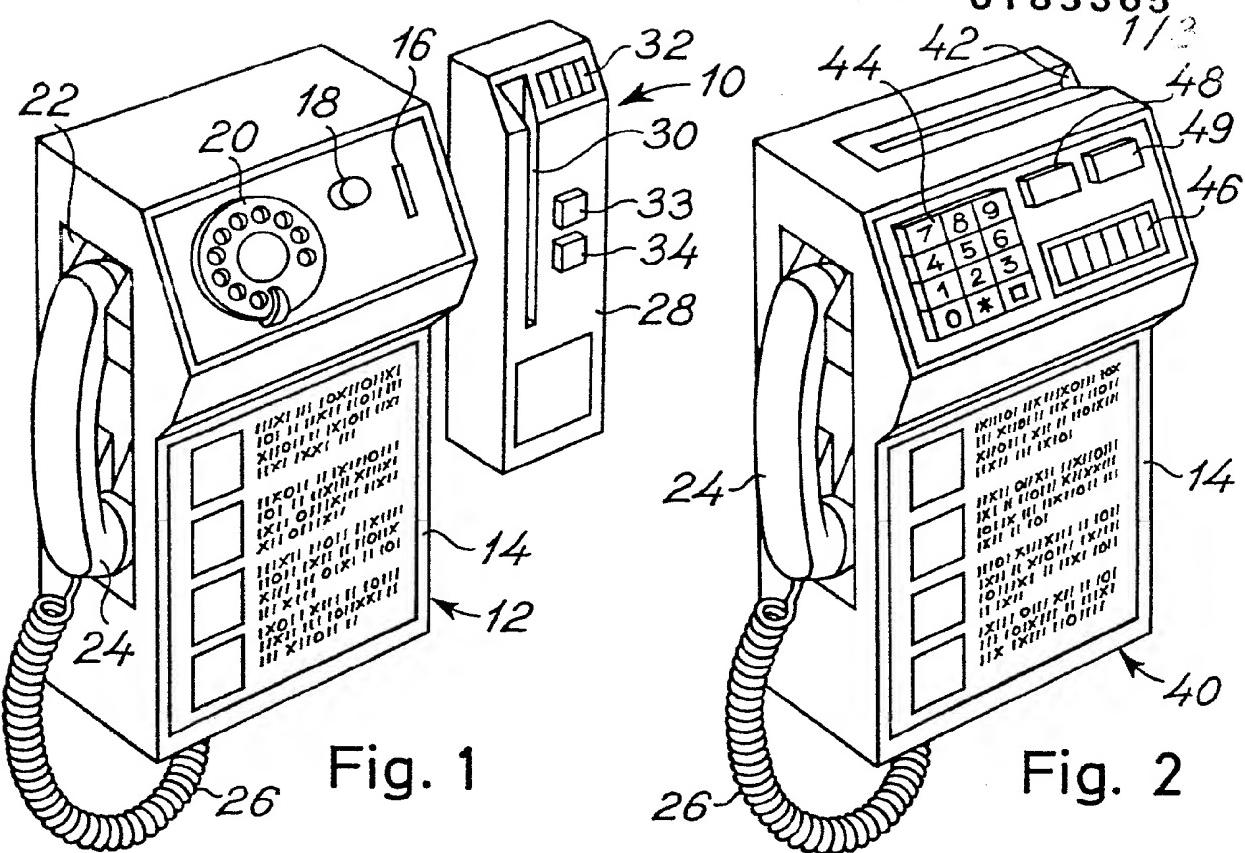
a debiting means for generating a signal representing a debiting amount corresponding to the duration of a service performance,

a subtraction means connected to the first storage means and the debiting means and for subtracting the debiting signal from said amount represented by the data read from the token so as to reduce the amount, the reduced amount being stored in first storage means and further being output to the writing means and written in the said token by the writing means at the conclusion of the service performance, and

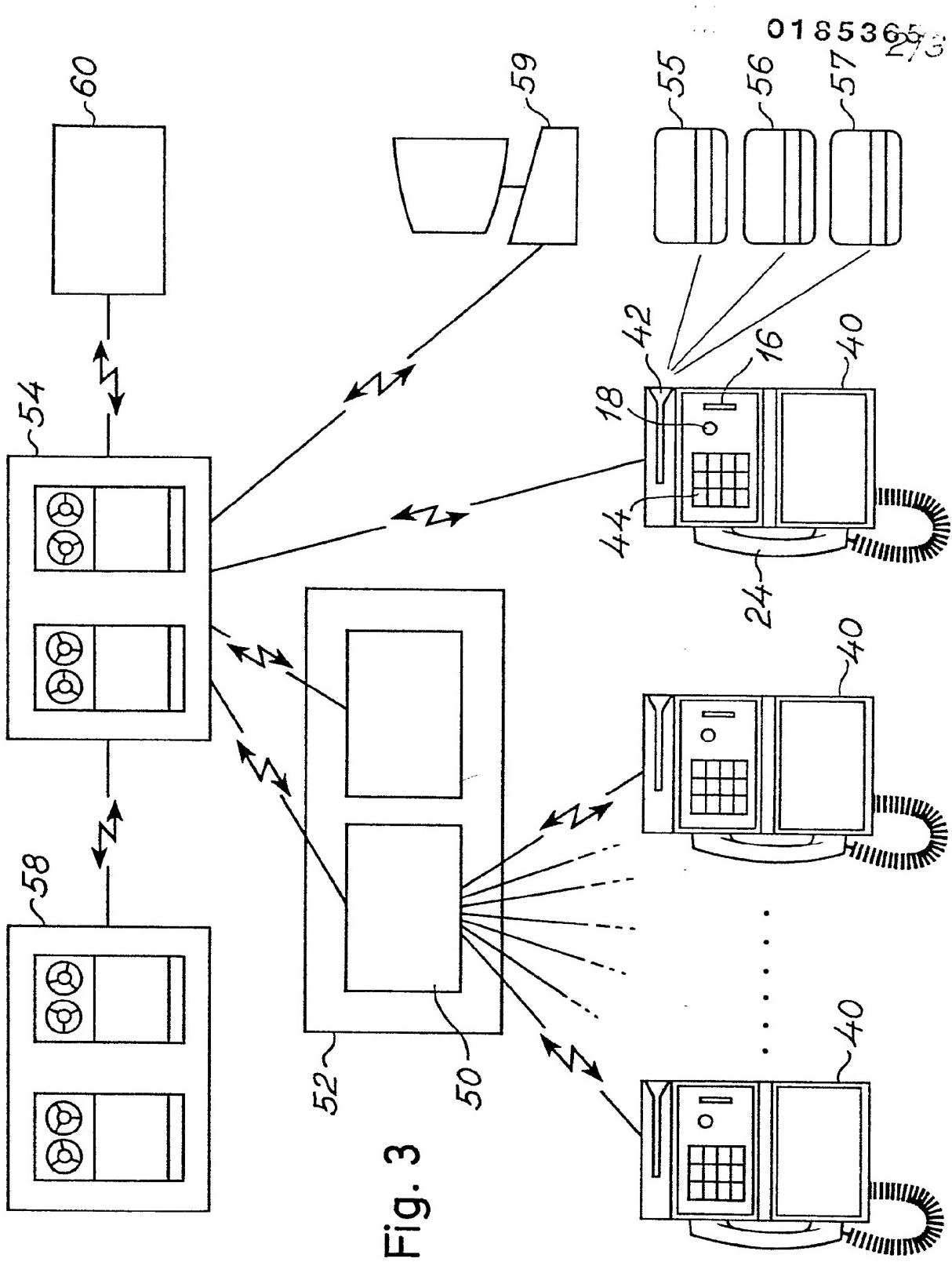
a gate means connected to the subtraction means and being supplied with said reduced amount during the service performance and for comparing the reduced amount and a predetermined threshold in order to interrupt the service performance when the reduced amount falls below said predetermined threshold;

the pay service apparatus being adapted to output data stored in the first storage means to the transmission line for transferring the data to the remote central computer for storing or processing therein after the conclusion of the service performance; and

the remote central computer being adapted to transfer data identifying legal tokens and data identifying illegal tokens to the second storage means of the pay service apparatus through the transmission line when the pay service apparatus is not in operation.

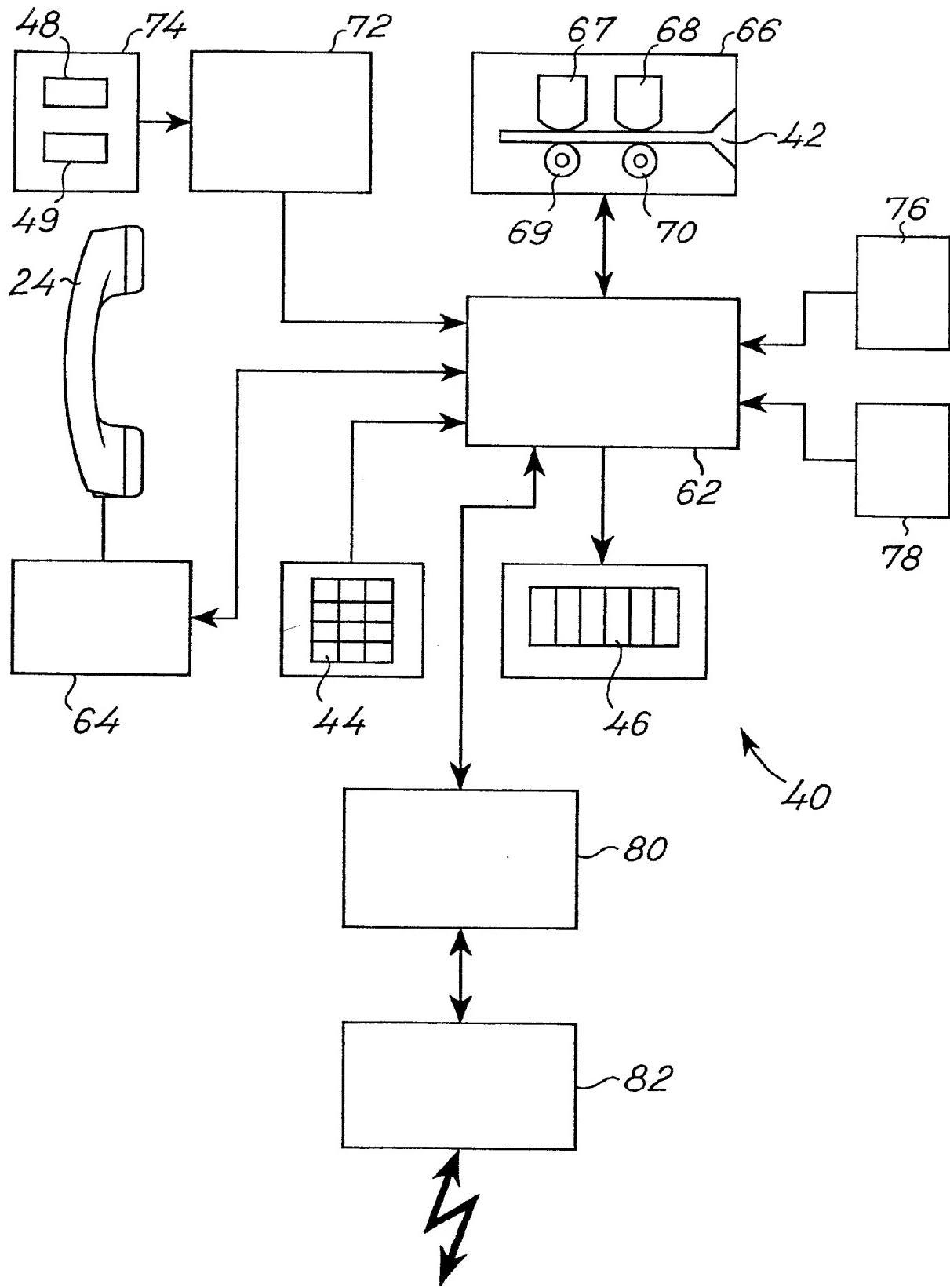


**Fig. 5**



**Fig. 3**

Fig. 4





DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
Y	WO-A1-84/01073 (KATZEFF ET AL) * Whole document*	1-17	H 04 M 17/00
	- - -		
Y	GB-A-2 065 353 (LGZ LANDIS & GYR ZUG AG) *Whole document*	1-17	
	- - -		
Y	EP-A1-0 041 261 (SIP SOC ITALIANA PER L'ESERCIZIO TELEFONICO P.A.) *Whole document*	1-17	
	- - -		
Y	FR-A1-2 286 565 (SELENIA-INDUSTRIE ELETTRONICHE ASSOCIATE S.P.A.) *Whole document*	1-17	
	- - -		
Y	GB-A-1 080 071 (JOHN WOLFGANG HALPERN ET AL) *Whole document*	1-17	H 04 M
	- - -		
Y	US-A-4 439 636 (NEWKIRK ET AL) *Whole document*	1-17	
	- - -		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	12-03-1986	FENGER-KROG S
CATEGORY OF CITED DOCUMENTS		
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		